

FURTHER OBSERVATIONS ON PHLOEOSTICHIDAE AND  
CAVOGNATHIDAE, WITH DEFINITIONS OF NEW GENERA  
FROM AUSTRALIA AND NEW ZEALAND

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INTRODUCTION

The new families Phloeostichidae and Cavognathidae were defined by Sen Gupta and Crowson (1969) to include forms previously referred by them (1966) to Boganiidae. Later studies have produced no evidence in support of a direct affinity of either Phloeostichidae or Cavognathidae to Boganiidae, but have tended to indicate affinities of both families to Cryptophagidae and Cucujidae. In the present study a new genus is defined within each of the 2 families, 2 genera are transferred to Phloeostichidae, new larval types are described in both families, and further data on habits of Cavognathidae are adduced.

Family PHLOEOSTICHIDAE Sen Gupta & Crowson 1969

This group is less satisfactorily characterised, and includes more heterogeneous forms, than Cavognathidae; its definition and extent are somewhat broadened to include the genus *Priasilpha* Broun and a related genus from Tasmania defined below. A revised definition of the family follows: *HEAD* with a constriction behind eyes leaving distinct temples, or apterous and with reduced eyes; fronto-clypeal suture rarely distinct; longitudinal grooves present behind maxillae, or apterous and with reduced eyes; mandibular cavities, if present, opening on dorsal surface; antennae 11-segmented with a weak 3-segmented club.

*THORAX* with front coxal cavities partially closed behind by hypomeral processes, with narrow to broad lateral extensions partly to wholly exposing trochantins. Mesepisterna without pockets at inner angles, middle coxal cavities widely open outwardly, trochantins exposed; elytra usually with rows of striae punctures, the suture, except in apterous forms, showing a distinct gap in its apical  $\frac{1}{4}$ . Meso-metasternal junction between coxae in a straight line or with a single metasternal knob; wings never with closed Radial or Anal cells, usually 5 Anal veins in main group. Legs with all trochanters short and normal, male tarsi heteromerous.

*ABDOMEN* with ventrite 1 lacking femoral lines and not much longer than 2; paratergites absent; aedeagus of cucujoid type with a single more or less broad median strut; ovipositor with all normal parts, proctiger, and paraprocts drawn out into distinct baculi.

If the family Phloeostichidae is not a very sharply defined group on adult characters, the task of defining it on larval characters is even more difficult in the present state of knowledge. To a great extent, such a definition is liable to be negative, based on the absence of special features of any other Clavicorn families. The larvae I have been able to study represent the genera *Priasilpha*,

*Hymaea*, *Rhopalobrachium*, and *Agapytho* and, except for the absence of *Phloeostichus* itself, constitute a fairly representative sample. An old description of the *Phloeostichus* larva (Ganglbauer 1899:605) is quite inadequate for modern systematic purposes, but suggests something similar to *Hymaea* or *Agapytho*. Hymaeinae seem to be larvally distinguishable from most, if not all, other Clavicornia by the fusion of the labrum to the clypeus without an evident suture, and Priasilphinae are similarly distinguishable by having the abdominal spiracles on long, branched, recurved, lateral processes; except for its greater number of ocelli, the *Agapytho* larva differs little from a basic Cryptophagidae type, or from some Languriidae or a supposed larva of *Ericmodes* (Protocucujidae).

It may well be that the subfamilies of Phloeostichidae would be better treated as independent families, with individual affinities to other Clavicorn families. *Phloeostichus* has slight resemblances to Cucujidae proper (e.g., *Pediacus*), *Hymaea* to Hyliotinae (e.g., *Dendrophagus*), and *Agapytho* is somewhat cryptophagid-like. Until stronger phylogenetic evidences become available, it is perhaps more practically convenient to retain these forms in one family.

### Revised Key to Subfamilies of Phloeostichidae

1. Meso- and metasterna meeting in a straight line between coxae; front trochantins almost entirely exposed; elytra with epipleura well defined nearly to apex; tarsal segment 1 distinctly shorter than 2; mandibles without cavities, aedeagus with distinct parameres ..... 2.
- 1'. Metasternum with a well developed knob received in mesosternum; front trochantins partially hidden, lateral angular extension of front coxal cavities narrow; epipleura distinct only near base; tarsal segment 1 not shorter than 2; mandibles with dorsal cavities, or aedeagus without articulated parameres ..... 3.
- 2(1). Species apterous, with reduced eyes (Fig. 1), head with post-ocular constriction indistinct or absent; prosternal process (Fig. 3) broader than long; tarsal segment 1 more than  $\frac{1}{2}$  as long as 2, 5 at least as long (Fig. 4) as previous 4 together; Australian and New Zealand species..... 1. PRIASILPHINAE
- 2'. Species winged, eyes well developed, head with well marked post-ocular constriction; prosternal process longer than wide; tarsal segment 1 not more than  $\frac{1}{2}$  length of 2, 5 shorter than 1-4 together; Holarctic species..... 2. PHLOEOSTICHINAE
- 3(1'). Mandibles with a well marked dorsal tubercle and cavity; aedeagus with articulated parameres; elytral punctures forming very distinct strial rows; side margins of prothorax more or less toothed; Australian and Chilean species ..... 3. HYMAEINAE
- 3'. Mandibles without dorsal tubercles or cavities; aedeagus without parameres; elytral punctures not forming longitudinal rows; side margins of prothorax sinuate but not definitely toothed; New Zealand species ..... 4. AGAPYTHINAE



## Subfamily PRIASILPHINAE

In addition to the New Zealand genus *Priasilpha* Broun, this group as here characterised will include a related Tasmanian form, for which the new genus *Priastichus* is defined below. The 2 genera may be distinguished as follows:

1. Eyes almost round; prosternal process (Fig. 3) less than twice as wide as long; elytra with 4 raised longitudinal ridges each, epipleura marrow; abdomen with 2 basal ventrites connate, ventrites together longer than width of basal one; Tasmanian species ..... *Priastichus* gen. nov.
- 1'. Eyes strongly transverse; prosternal process more than twice as wide as long; elytra without raised longitudinal ridges, epipleura very broad in basal 2/3; abdomen with all ventrites free, together not longer than width of basal one; New Zealand species ..... *Priasilpha* Broun

## PRIASILPHINAE

In addition the characters given in the key, Priasilphinae may be defined as follows:

**HEAD** with no trace of frontoclypeal suture, labrum very transverse, antennal insertions not covered by margins of frons, antennae rather slender with weak 3-segmented club, anterior gular region with some trace of longitudinal grooves, gular sutures somewhat convergent in front, tentorium of normal form with well developed laminatentorium, mandibles with 2 apical teeth, a rather large membranous setose prostheca and strongly developed mola, the latter with small asperities forming numerous transverse rows.

**PROTHORAX** transverse, with side margins sharp, somewhat angled or incised; hypomerall processes extending about 2/3 of way to meet prosternal process.

**ELYTRA** with side margins curved, a sharp basal margin as far as scutellum, sutural margins not divergent near apex, scutellum exposed, small, transverse; middle coxae separated by a distance at least equal to their longitudinal width.

**METATHORAX** with sternum short, very transverse, without median groove, hind coxae separated slightly more widely than middle ones; metendosternite with very short broad stalk, anterior tendons widely separated. Legs rather slender, femora little inflated in middle, all tibiae with 2 normal apical spurs.

**ABDOMEN** with tergites 1-6 pale and membranous, 7 sclerotized and pigmented, 8 hidden under 7; aedeagus with basal strut of median lobe very broad, ovipositor with all normal parts distinct, paraprocts and proctiger forming 2 pairs of well sclerotized short baculi (Fig. 5).

*Priastichus* Crowson, NEW GENUS

Type species, *P. tasmanicus* sp. nov.

In addition to the characters indicated in the subfamily definition and the key to genera, the genus may be defined as follows:

*HEAD* (Fig. 1) with small round lateral eyes, the capsule slightly contracted immediately behind them, without distinct temples; sides of front raised above antennal insertions, labrum somewhat deflexed, its front margin evenly rounded; anterior gular region with well marked longitudinal grooves behind maxillae (Fig. 1). Antennae rather slender, segments as figured (Fig. 2). Mandibles without cavities, single-toothed at apex, molar part with transverse ridges, prostheca represented by an obtuse setiferous protuberance in front of mola.

*PROTHORAX* with front margin scarcely narrower than hind margin, sides broadly explanate, broadest near middle, where they are distinctly incised (Fig. 3), strongly contracted to hind angles, hind margin not bordered.

*Scutellum* very transverse, almost rectangular.

*Elytra* with 4 more or less interrupted raised longitudinal ridges between suture and outer margin, the 1st and 4th joining just before apex, the 2nd ending just before this junction and the 3rd ending before the 2nd; punctures showing no indications of striae; outer margin only slightly curved in basal 2/3.

*Metepisterna* not covered by epipleura, punctured like metasternum.

*Abdomen* with ventrites 1-4 decreasing progressively in length, ovipositor as figured (Fig. 5), tergite 7 large and distinctly sclerotized, with spiracles in its edges.

*Legs* rather slender, femora almost parallel-sided, tibiae only slightly widened to apex.

*Priastichus tasmanicus* Crowson, NEW SPECIES

General colour dark chestnut brown, derm shining and without evident micro-sculpture but more or less covered by a dull greyish waxy layer. Upper surface with rather short, sparse, stout, recurved setae.

*HEAD* with about 10 ommatidia along a meridional line of the eyes, vertex rather closely punctured with irregularly oriented kidney-shaped punctures, each bearing a short recurved seta, occiput with much finer punctures, their setae directed forwards. Side of front markedly raised above antennal insertions.

*PROTHORAX* shaped as figured (Fig. 3), side margin broadly explanate and somewhat raised, notum with broad shallow impressions by front and hind angles, its central part markedly convex, punctured as vertex of head, setae on disc mainly directed towards centre.

*ELYTRA* with punctures rather larger and more rounded than those of head and pronotum, moderately close, even and irregular, absent on the crests of the ridges; the longitudinal ridges all more or less interrupted, the innermost one with about 5 interruptions, the second with 5 interruptions, the 3rd with 3, the 4th distinct only in apical half where it is twice interrupted.

Overall length of holotype, 4.8 mm, maximum width of prothorax 2.4 mm, length of prothorax 1.3 mm, maximum width of elytra 2.8 mm.

Holotype female, Highland of Burnie, Tasmania, March 1957, P. J. Darlington; paratype female, dissected and mounted on slide, Ben Lomond, c. 5000 ft., Tasmania, March 1957, P. J. Darlington [Museum of Comparative Zoology, Harvard University, Cambridge, Mass. USA]



## Subfamily HYMAEINAE Sen Gupta &amp; Crowson 1969

As originally defined, this group included 2 genera, *Hymaea* Pascoe and *Rhopalobrachium* Bohemann. As a result of studies of the skeletal structures of *Anaplopus tuberculatus* Blackburn it is evident that it belongs in Hymaeinae rather than in Pedilidae to which it was originally attributed, or Tenebrionidae among which it was placed by Abdullah (1966); the inclusion of the additional genus does not involve any change in the definition of the group. The 3 genera may be distinguished as follows:

1. Species larger (length at least 15 mm), tibiae distinctly keeled along outer edge; head with well defined fronto-clypeal groove; middle coxae separated by a distance equal to their apparent width; Chilean species .....  
..... *Rhopalobrachium* Bohemann
- 1'. Species smaller (length not more than 10 mm); tibiae not keeled on outer edge; middle coxae separated by less than their apparent width; Australian species ..... 2
2. Head with a transverse groove in front of frons; prothorax without distinct side margins; tarsi very slender; species larger ..... *Anaplopus* Blackburn
- 2'. Head without a transverse groove between antennae; prothorax with side margins distinct, more or less toothed; tarsi less slender, species smaller ..... *Hymaea* Pascoe

## Family CAVOGNATHIDAE Sen Gupta &amp; Crowson 1969

By the kindness of Dr. J. C. Watt, I have been able to study adults and larvae from New Zealand representing a new genus and species having all the characteristics of this family as previously defined.

## Revised Key to Genera of Adult Cavognathidae

1. Apical margin of clypeus angularly emarginate. Mandibles with 2 cavities. Tarsal segments 2 and 3 slightly lobed below, 4 markedly smaller than 3. New Zealand species .....  
..... *Neocercus* Broun
- 1'. Apical margin of clypeus straight or curved. Mandibles (Fig. 6) each with a single cavity. Tarsi, at least in females, with segments 2 and 3 not distinctly lobed below, 4 scarcely smaller than 3..... 2.
2. Front anteriorly with a deep transverse groove. Antennae thick, segments 4-8 transverse, about equal in length. Abdominal segments 2-6 with well defined paratergites. Head with post-ocular constriction immediately behind eyes, no distinct temples. Australian species ..... *Cavognatha* Crowson
- 2'. Front anteriorly without transverse groove. Antennae thinner, segments 4-8 not transverse, alternately longer and shorter. Abdominal segments with paratergites absent or incompletely separated. Distinct temples present, post-ocular constriction not immediately behind eyes ..... 3.

3. Front coxal cavities almost closed behind by epimeral processes (Fig. 8). Abdominal segments 2-6 with paratergites partly separated. Prothorax less narrowed in front of middle than behind it (Fig. 8). Ventrites 2-4 with characteristic oblique impressions near front angles (Fig. 9). New Zealand species ..... *Zeonidicola* gen. nov.
- 3'. Front coxal cavities more widely open behind. Abdominal segments with no trace of paratergites. Prothorax at least as much narrowed in front of middle as behind it. Ventrites 2-4 without such marked impressions. Chilean and ?Australian species ..... *Taphropiestes* Reitter

### *Zeonidicola* Crowson, NEW GENUS

Type species *Z. dumbletoni* sp. nov.

In addition to the characters indicated in the key, the genus may be characterised as follows:

**HEAD** with front margin of clypeus emarginate, markedly raised above very short labrum; post-ocular constriction continued as a sharp dorsal line separating vertex from occiput. Antennal club very weak, segment 11 elongate (Fig. 7).

**THORAX** with prothorax distinctly angled at sides just in front of middle, very slightly contracted to front angles, more strongly so to hind angles (Fig. 8). Scutellum very transverse, rectangular with rounded hind angles. Elytra somewhat depressed immediately behind scutellum. Mesosternum with ridges delimiting an almost regular hexagonal central part in same plane as metasternum.

**ABDOMEN** with ventrites 2-5 with characteristic oblique impressions close to front angles (Fig. 9), retracted aedeagus turned on its R side, as figured (Fig. 10), with a single broad median strut.

### *Zeonidicola dumbletoni* Crowson, NEW SPECIES

**HEAD** with vertex shining, rather diffusely punctured in middle, more closely towards front and side margins, setae recumbent, directed mainly backwards, longer than average distance between adjacent punctures; antennal segments as figured (Fig. 7).

**THORAX** with pronotum rather more strongly and closely punctured than vertex, interstices smooth and shining, a rather broad unpunctured median line in posterior two-thirds, setae recumbent, directed towards centre, those of side margins directed forwards. A shallow indistinct impression on either side of smooth median line in basal half. Scutellum finely punctured and pubescent.

**Elytra** rather more closely punctured than pronotum, its setae recumbent and directed backwards, interstices finely sculptured and slightly dull.

Overall length about 3.3 mm, maximum width of prothorax 0.65 mm., length of elytra 1.9 mm.

Holotype and 9 paratypes, plus 9 larvae, from nestlings of *Stictocarbo punctatus* (spotted shag, family Phalacrocoracidae).

The fact that adults of *Cavognatha pullivora* Crows. have been found only



in nests, and larvae on nestlings, of *Gymnorhina tibicen*, while *Zeonidicola* has been found exclusively in a similar association with *Stictocarbo punctatus*, and that adult beetles found in the nests of *Smicrornis brevirostris* (Chisholm 1952) were identified by J. Balfour Browne as "*Taphropiestes* sp.", suggests strongly that birds' nests may be the general and ancestral habitat of Cavognathidae. The fact that the 3 bird species mentioned belong to widely different families with widely different nesting habits suggests in turn that the beetle-bird association in this case may be an old one, and that more species of Cavognathidae may remain to be discovered. If Cavognathidae are a "good"

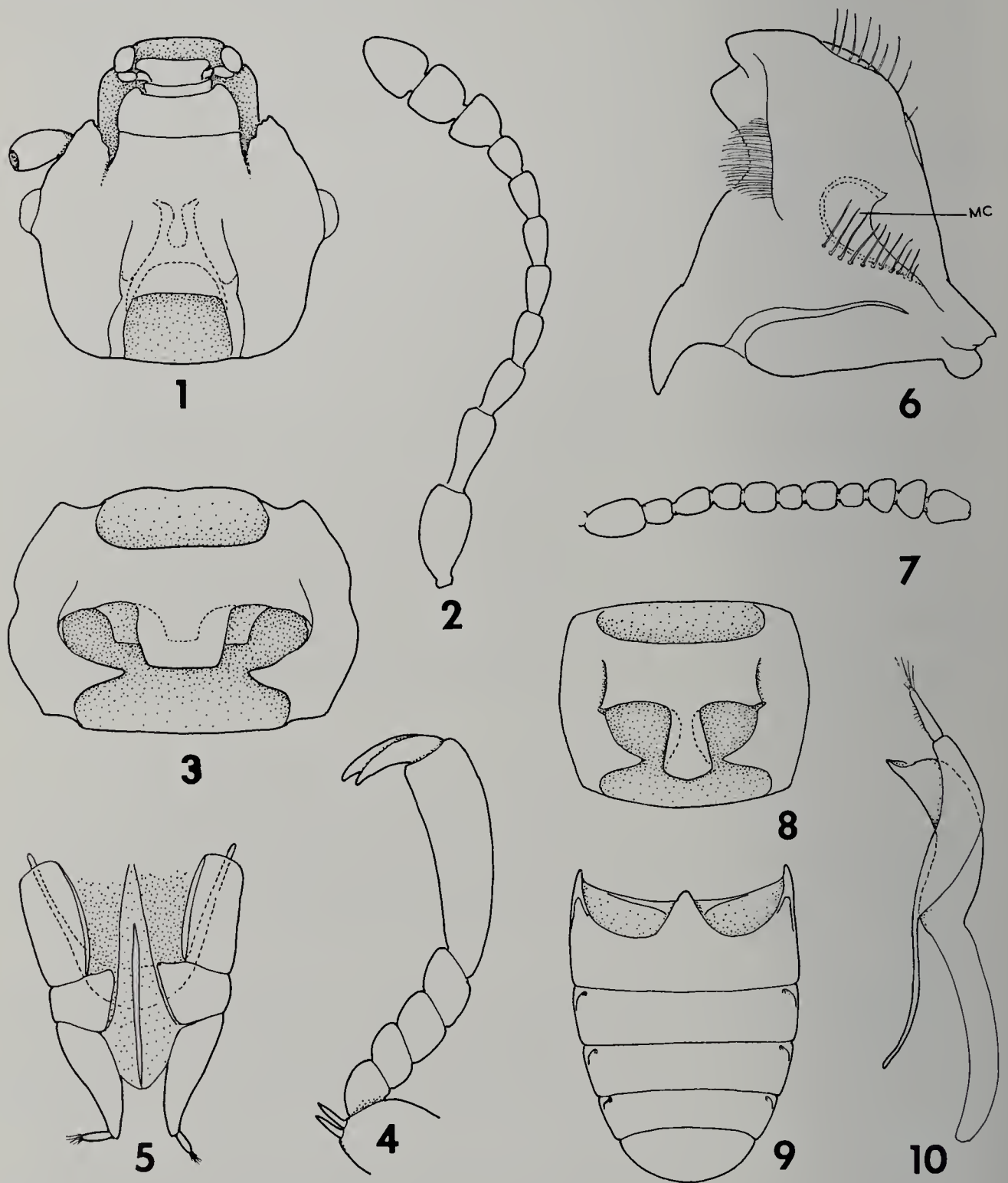


Fig. 1-5. *Priastichus tasmanicus*: 1) head, ventral view, mandibles and maxillae removed, 2) antenna, 3) prothorax, ventral view, legs removed, 4) tarsus, 5) ovipositor, ventral view.

Fig. 6-10. *Zeonidicola dumbletoni*: 6) R mandible, dorsal view, 7) antenna, 8) prothorax, ventral view, legs removed, 9) abdomen, ventral view, 10) aedeagus, lateral view.

family of Coleoptera, then their separate ancestry should go back into the Mesozoic period, and might well be about as old as that of Neornithan birds (first known as fossils from the Cretaceous period). If the closest existing relatives of Cavognathidae are Cryptophagidae, then it may be significant that quite a number of species of the latter family have been recorded from birds' nests (Hicks 1959).

### The Positions of Phloeostichidae and Cavognathidae in Clavicornia

In the revision by Sen Gupta & Crowson (1966) of part of the key to families of Clavicornia of Crowson (1955), couplets 12 to 15 should be modified as follows:

12. Front coxal cavities broadly closed behind, with no trace of angular lateral extensions; tarsi not at all lobed below, segment 5 as long as 1-4 together, with a conspicuous empodium; head with subocular antennal grooves ..... HELOTIDAE  
 --. If front coxal cavities broadly closed behind, tarsi more or less lobed below and with segment 5 much shorter than 1-4 together; head without subocular antennal grooves ..... 13.
13. Elytral suture showing a distinct gape in apical  $\frac{1}{4}$ , or species apterous; head nearly always with longitudinal grooves behind maxillae; front coxal cavities open behind; retracted aedeagus never inverted, median lobe with a single broad median strut; wings with 5 Anal veins in main group, no closed Radial cell; tarsi 5-5-4 segmented in male, or mandibles with cavities opening on their outer edges; front coxae with trochantins partially to completely exposed ..... 14.  
 --. Elytral suture without a gape, species rarely apterous; head rarely with longitudinal grooves behind maxillae; front coxal cavities often closed behind; retracted aedeagus often inverted, median lobe never with a broad median strut; if wings with 5 Anal veins and no closed Radial cell, front trochantins hidden ..... 15.
14. Mandibles with cavities, if present, opening dorsally; male hind tarsi 4-segmented; elytra with more or less distinct rows of punctures; front coxal cavities with lateral extensions broad, exposing large part of trochantin ..... PHLOEOSTICHIDAE  
 --. Mandibles with cavities opening laterally; male hind tarsi 5-segmented; elytra without distinct rows of punctures; lateral extensions of front coxal cavities narrow, exposing only a small part of trochantin ..... CAVOGNATHIDAE
15. Trochantins of front coxae broadly exposed; tarsal segment 1 at least as long as 2; retracted aedeagus not inverted; posterior constriction of head immediately behind eyes, no distinct temples; species not markedly flattened ..... BOGANIIDAE  
 --. Trochantins of front coxae narrowly exposed or hidden; tarsal segment 1 much shorter than 2, or front coxal cavities broadly closed behind; head constricted some way behind eyes, with distinct temples; species usually flattened ..... 15a



- 15a. Male hind tarsi usually 4-segmented, tarsi never with segments markedly lobed below; front coxal cavities usually open behind, with narrow external slit-like extensions, or all coxae more or less widely separated; wings often with closed Radial cell ..... CUCUJIDAE
- . Male hind tarsi 5-segmented, tarsi usually with segments 2-3 more or less lobed below and 4 small; front coxal cavities never with slit-like extensions, nor widely separated, usually closed behind; wings never with closed Radial cell ..... SILVANIDAE

As defined in the above key, Silvanidae will include Uleiotaenae (Hyliotinae), previously placed in Cucujidae. The Passandridae of Crowson (1955) clearly belong in the immediate neighbourhood of, if not actually in, the Cucujidae. A new key to the families of adult and larval Clavicornia is in preparation by the present author and T. Sen Gupta.

The Phloeostichidae show apparent affinities to Protocucujidae, and also to Cucujidae and Silvanidae, the former particularly through *Phloeostichus* and the latter by way of Hymenaeinae; *Agapytho* seems to lean more towards Cavognathidae and Cryptophagidae. Cavognathidae seem to be linked with Phloeostichidae on one hand and Cryptophagidae on the other, but not evidently to any other Clavicorn families.

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